Future Chemical/ Biological Ensemble Ground Soldier System (FCBE-GSS) Technology Demonstration

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FCBE-GSS Demo Presentation Overview

- Background & Objectives
- System(s) overviews
- Technical & User Demonstration
- Results Overview
- Summary

FCBE-GSS Background

- **Collaborative effort between:**
  - **DTRA JSTO-CBD** -Defense Threat Reduction Agency Joint Science & Technology Office Chemical & Biological Defense
  - **NSRDEC**-Natick Soldier Research Development and Engineering Center
  - **PEO-Soldier**-Program Executive Office Soldier
  - **JPEO-CBD**-Joint Program Executive Office for Chemical & Biological Defense (JPM-P , JPM-IS)
- **MOA signed 25 Mar 08**
- **Technology Transition Agreement** in place with Joint Project Managers for Protection (JPM-P), and Information Systems (JPM-IS) and Program Executive Office- Soldier (PEO-Soldier)
- **Multi-agency partnership** (includes ECBC, ARIEM, ATC, AEC, SPAWAR-Pacific, industry)

Systems Integration

Demonstrate integration of CB individual protection technologies into a " Warfighter System" using GSS (Nett Warrior) as the demonstration platform

Integrate CB Protection into the helmet

- Leverage technologies from JSTO-CBD funded programs; Heads-up ATO (NSRDEC) and industry

Integrate CB protection into "duty uniform like" ensemble:

- Achieve equivalent thermal performance to the Flame Resistant Combat Uniform (FR-ACU) and determine best achievable CB performance ***(Identify Trade-offs)***
- Integrate materials from industry and JSTO-CBD S&T Programs (Integrated Protective Fabric System)

Integrate CB sensors and warning and reporting system with the Future GSS Network (Nett Warrior)

- Improve Situational Awareness

Integrates and compatible with Combat Gear

•Load carriage; body armor; communications; electronic equipment; future Nett Warrior network

Different Needs – Time Driven

Immediate Need

Quick donning capability
Enough protection to exfil from threat

Notional Scenario:
Infantry unit encounters a Chemical IED

Short Duration PRIMARY FOCUS OF TECH DEMO

Quick donning capability
Long duration protection

Notional Scenario:
House clearing operation encounters a clandestine chemical lab

Long Duration

Notional Scenario:
Chemical reconnaissance team gathers samples

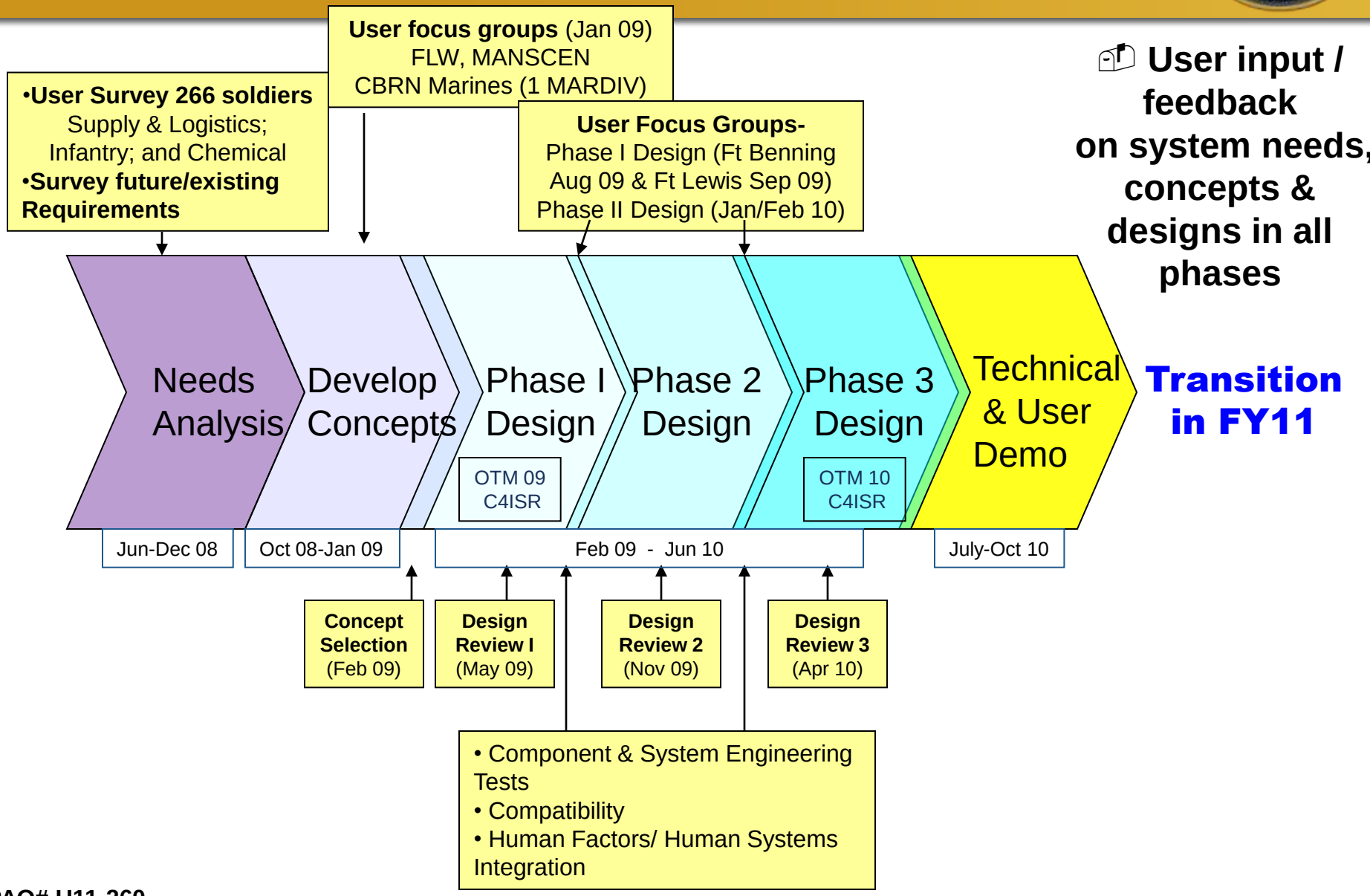
Time, weight, size are not priority issues
Enough protection to exfil from threat

Notional Scenario:
Deliberate Decontamination of personnel or equipment

Time, weight, size are not priority issues
Long duration protection

Deliberate Need

Systems Engineering Process & Timeline



FCBE-GSS Demo Concepts

Government Led Concepts

4 Ensemble Designs

- Industry materials (CBCU & CBUG)
- IPFS Materials (CBCU-IPFS)
- NSRDEC laminate (E-FRACU over CBUG)
- Industry boots & gloves

2 CB Head-Gear Integrated Designs

- CB RAM (low profile & duration)
- CB PRISM

CB & GSS Sensor & Network Integration

- JCAD
- JOAC
- JWARN and GSS

Industry

Industry Materials

- Request for Information
- Approximately 41 materials evaluated
- Materials used in gov't concepts

4 Ensembles Requisitioned

- Manufacturer off-the-shelf design concepts

Integrated Ensemble Concept Design

- Contract awarded to develop CB Integrated Combat Uniform Concept Ensemble that is optimized for thermal performance

CB Integrated head-gear Solution

- Contract awarded to explore ground variant concept of the MACH.
- Focuses on exploring split mask concept for CB integrated head-gear

Chemical/Biological Combat Uniform (CBCU)

Design

- Low thermal burden CB protective combat uniform
- Multiple venting strategies
- Tortuous path waist interface
- Cowl neck integration design
- Worn with the CB PRISM Head Gear

Materials

- Torso: 10.6 oz/sqyd Activated Carbon Stretch material
- Sleeve/Trouser: Woven, nylon/cotton outer-shell laminated to activated carbon layer- 10.3 oz/sqyd

Integrated Protective Fabric System (IPFS)

Design

- Low thermal burden CB Combat Uniform
- Multiple venting strategies
- Cowl Neck Integration Design

Materials

- Integrates Materials from IPFS S&T Program (DTRA/NSRDEC)
  - CWA Protection (barrier, sorptive and reactive material technologies)
  - Top surface antimicrobial treatments (kills spores, bacteria, fungi, *viruses*)
  - Integrated aerosol filter material
- Torso: Tri-Laminate Stretch Material (Newsorb)
- Sleeve/Trouser:
  - Shell- CleanShell Finished Para-aramid textile
  - Inner Layer-Thin membrane (PVAM) &activated carbon laminate material

Chemical/Biological Protective Integrated System Mask (CB PRISM)

Design

- Integrated Head Gear System Leveraging a HeadsUp-ATO helmet design
- Don mask without removing helmet
- Full-time filter – No hot swap capability
- Twin-filter design integrated into the helmet liner
- Split axial flow filter design, to maximize surface area.

Materials

- Filter :Impregnated, activated carbon in a flexible webbing and electret particulate media
- Activated Carbon Stretch material used in cheek

Airflow

Chemical/Biological Undergarment (CBUG)

Design

- Low thermal burden undergarment design
- Worn under the duty uniform
- Worn with the CB RAM and CB balaclava
- Concealable protective system
- Deliberate donning scenarios

Materials

- 10.6 oz/sq2 Activated Carbon Stretch material

Enhanced Flame Resistant Army Combat Uniform (eFRACU)

Design

- FRACU design with closures modified for CB protection
- Worn over the CBUG
- Layered System for additional CB protection
- Worn with the CB RAM and CB balaclava

Materials

- Outer Layer: Flame Retardant Nonwoven Material (60/40 FR Rayon, Para-aramid)
- Inner Layer: 6.0 oz/sqyd carbon stretch material
- Composite weight: 9.2 oz/sqyd

Chemical/Biological Rail Attaching Mask (CB RAM)

Design

- Integrated face piece system with HeadsUp-ATO helmet design
- Don mask without removing helmet via helmet rails
- Escape mask or riot control type use
- Filters embedded in mask result in low profile
- Split axial flow filter design with lower surface area than PRISM

Materials

- Filter :Impregnated, activated carbon in a flexible webbing and electret particulate

Approach for Technical and User Demonstration

Baseline ensembles/ components include in all testing

Technical

- System

- Component

Demonstrate Objectives

User

Operationally Relevant Environment

- Individual and Collective Tasks
- Full systems, including combat gear
- 13 Infantry and Chemical MOS Soldier participants

User Demonstration Main Events

Individual Task Performance

- Road March
- Portability Course
- MOUT
- Grenade Throw
- Automatic Weapon Firing (blanks & simulator)
- Cognitive Activities (Pre and Post-exertion)
- Timed Donning
- Range of Motion
- Vehicle Operations

User Demo Excursions

Scenarios provide a variety of doctrinally sound venues in which participant soldiers evaluate the performance of technologies and capabilities in an operationally relevant environment

- **Conduct Presence Patrol** (performed by Rifle Squad/ Fire Team based on threat and area
- **Conduct a Cordon and Search -** conducted at Company level, based on threat and area.
- **Sensitive Site Assessment (SSA) -** Performed by SSA Team and supported by Combat Units to provide area isolation and security

FCBE-GSS Ensembles Thermal & Chem Performance

% Improvement in Warfighter Predicted Endurance Time (Thermal) compared to CB Baseline Ensemble

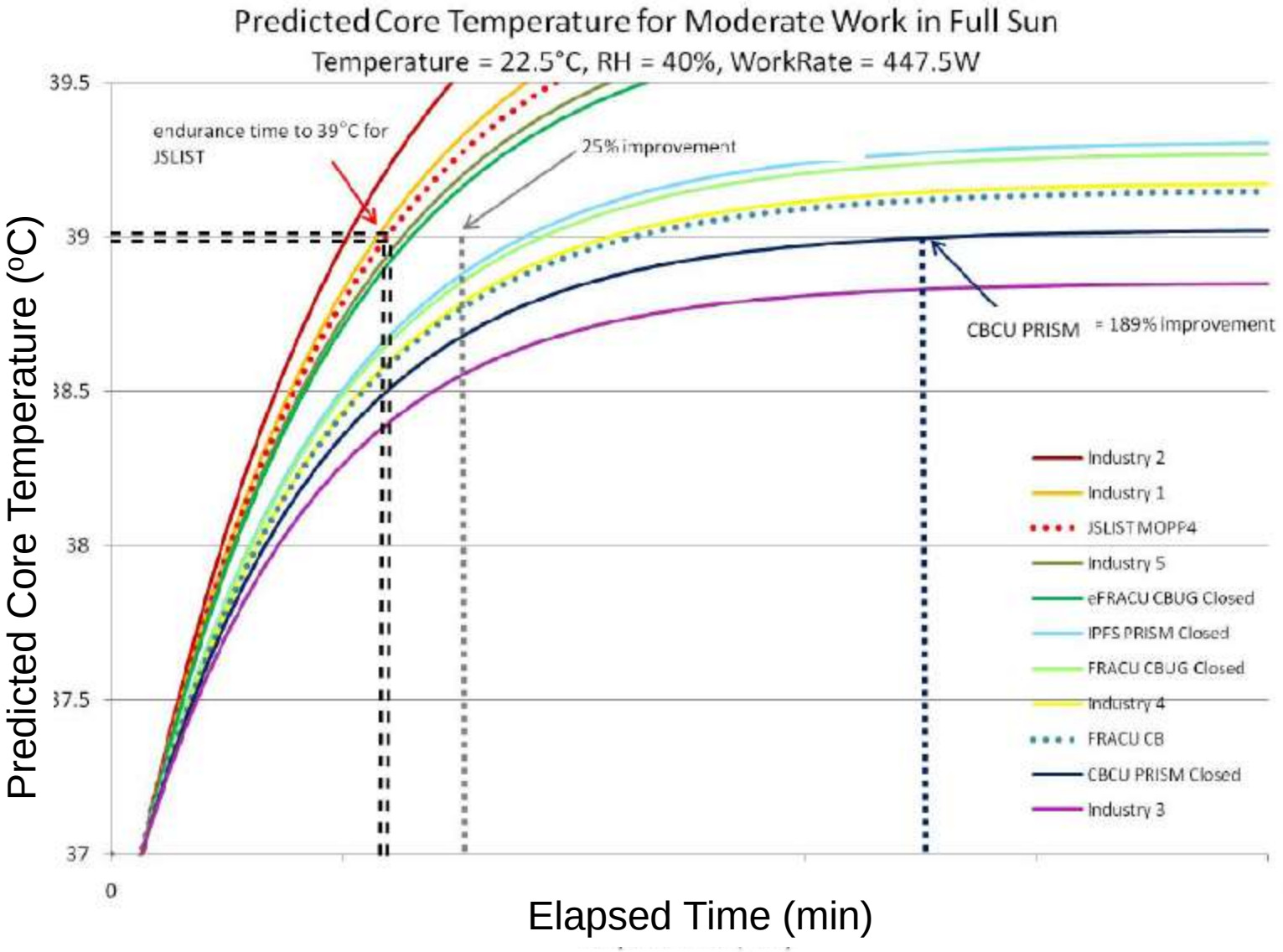
Heat Strain Decision Aid Modeling Results

Air temp (C)	22.5	30	40	User Demo Thermal Comfort Data (% increase)	Protection Compared to CB Baseline
RH %	40	25	12.5		
Work rate (W)	447.5	435	435		
	full solar	full solar	full solar		
Industry #2	-15	-17	-20		Reduced*
Industry #4	-4	-9	-14		Reduced*
JSLIST MOPP4	--	--	--	--	--
Industry #4	3	-2	-5		Reduced*
Industry #5	6	2	-4		N/A
eFRACU CBUG	8	5	0	8	Same
IPFS PRISM	49	27	13	38	Reduced
FRACU CBUG	54	34	21	24	Same
FRACU CB	86	48	29		--
CBCU PRISM	189	70	38	35	Reduced
Industry #3	317	98	36		Reduced*

All Testing Performed with Full Combat Load

* Industry ensemble CB Protection Data limited to AST and MIST limited replicates

FCBE-GSS Ensembles Thermal Performance



CB Integrated Head-Gear General Findings

CB PRISM Integrated Filter Concept

- Advantages:
  - Filter removed from front of face
  - High surface area available for filtration and lower breathing resistance
  - Integration- mask, head gear and components
  - Improved Mask/helmet stabilization
  - Don mask without removing helmet
  - Cowl neck, to integrate helmet/mask and garment, provides for better thermal comfort especially in non-CB mode where it is rolled up in a stowed configuration. Overall good user acceptability of cowl in terms of comfort
- Disadvantages
  - Potential/unknown impacts to helmet performance
  - Filters cannot be changed during missions
  - Larger helmet surface area introduces interference issues
  - Filter ducting system may introduce leakages
  - Sound localization & weapons compatibility reduced

CB Integrated Head-Gear General Findings

CB RAM- Helmet attached filter concept for lower challenge & duration scenarios

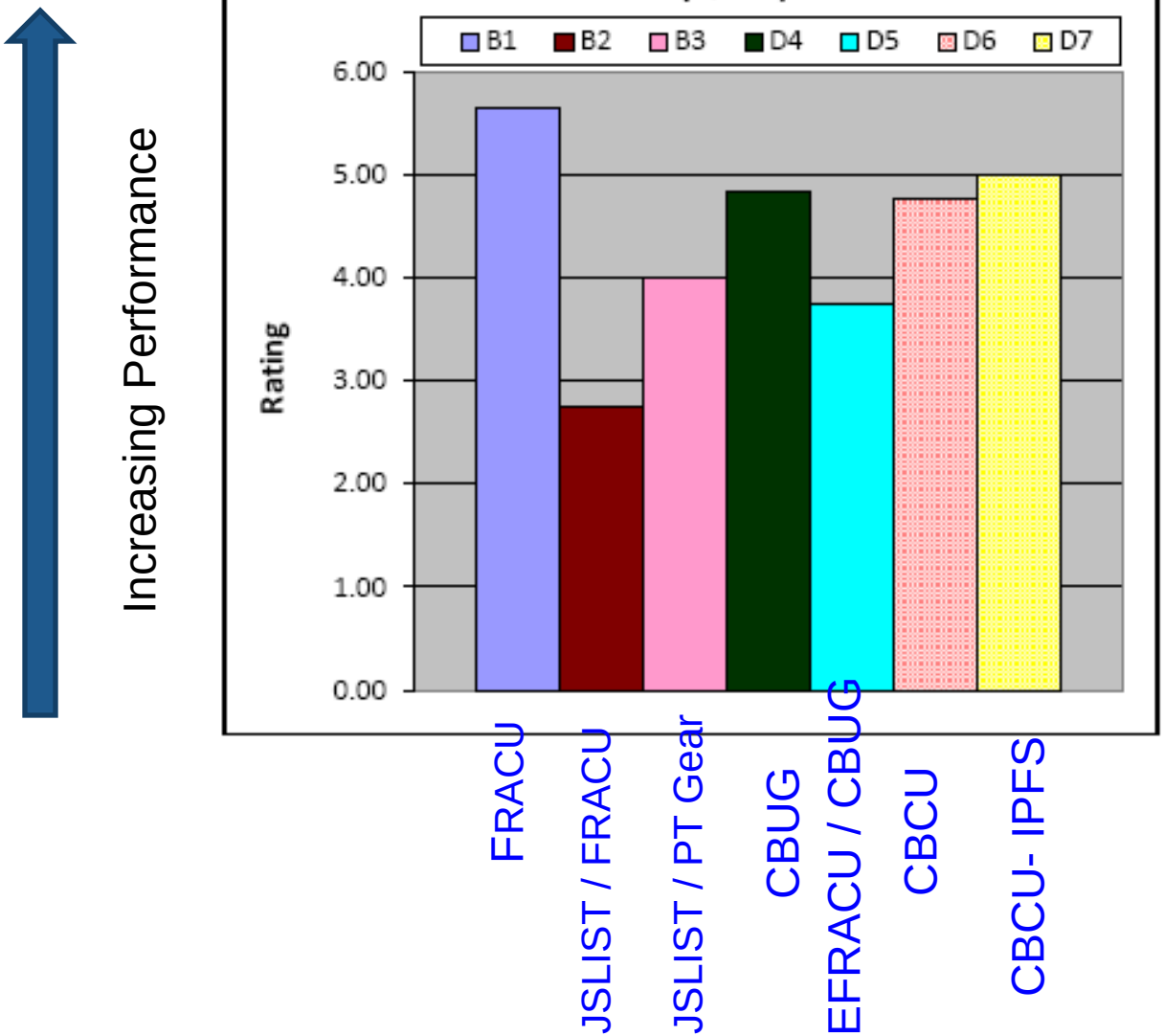
Advantages

- Lower profile minimizes interface with weapons and sighting systems
- Reduced bulk - Lower weight
- Integration- mask, head gear and components
- Improved Mask/helmet stabilization
- Don mask without removing helmet (if balaclava already worn)
- CB RAM concept favored by users
- MIST data suggests balaclava offers good protection

Disadvantages

- Filter will require to grow from CB RAM design to even meet lower challenge level and duration scenarios. Significant improvements to sorbent media technologies required.
- Embedded filter not replaceable
- Requires wearing balaclava under helmet
- Balaclava requires helmet removal to don mask and reduces thermal comfort

User Demo Findings- Example



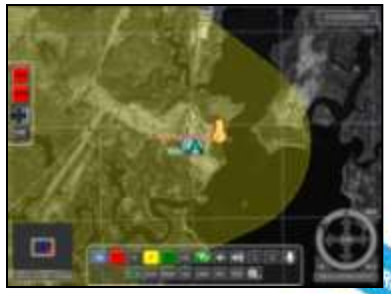
Soldiers rating of:

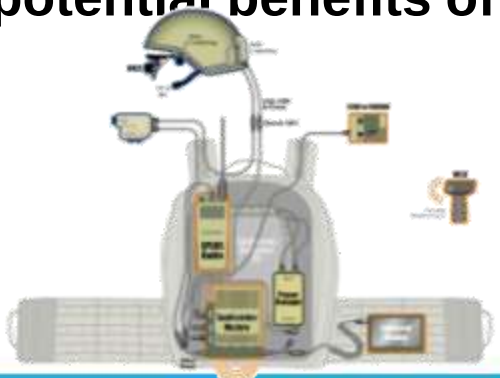
Overall Ability (of Soldiers) to accomplish Mission Critical tasks and movements effectively

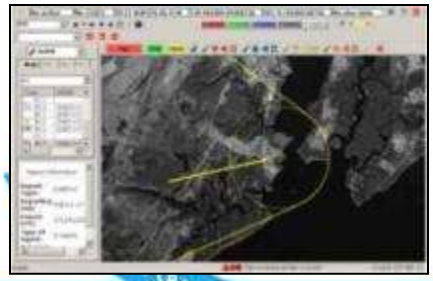
CB Sensor & Network Integration

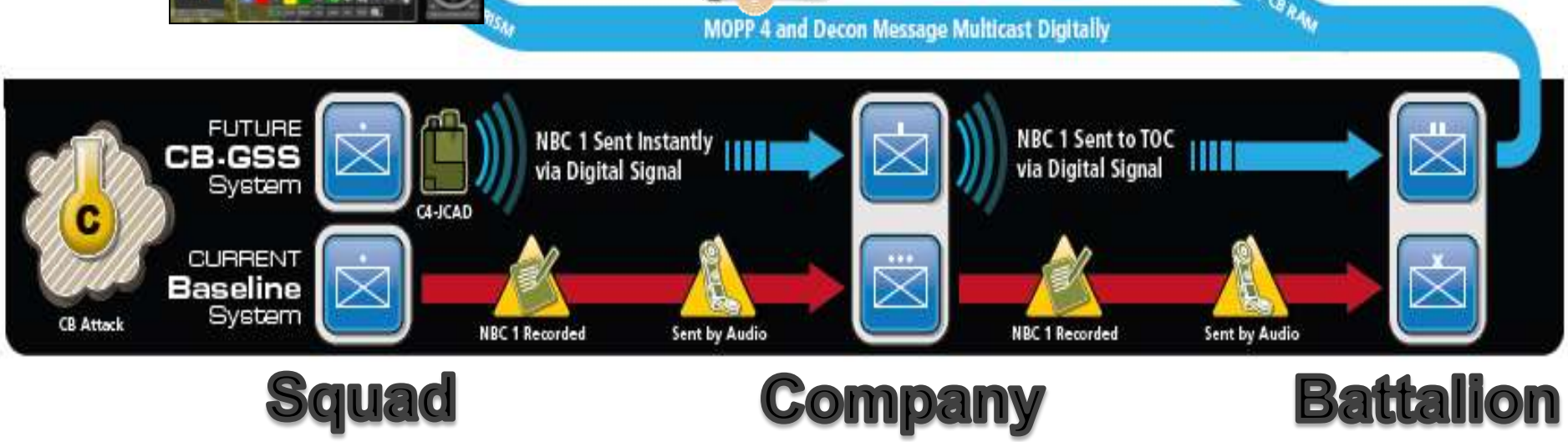
Increase Situational Awareness for the Warfighter

- Demonstrate ability to integrate sensors and networks (JWARN/Future Nett Warrior)
- Assess potential benefits of capability









CB Sensor & Network Integration

- **Demonstrated sensor and network integration with the S&T version of the Nett Warrior Platform (Soldier Domain Technologies (SDT))**
  - Joint Chemical Agent Detector (JCAD) integrated onto the Ground Soldier platform via Common CBRN Sensor Interface (CCSI) protocol and using the JCID on a Chip Software version
  - SDT and JWARN Networks integrated
  - Automated sensor information sent as NBC messages to and from the Soldier
  - Real time CBRN Situational Awareness information displayed on the Soldier Map

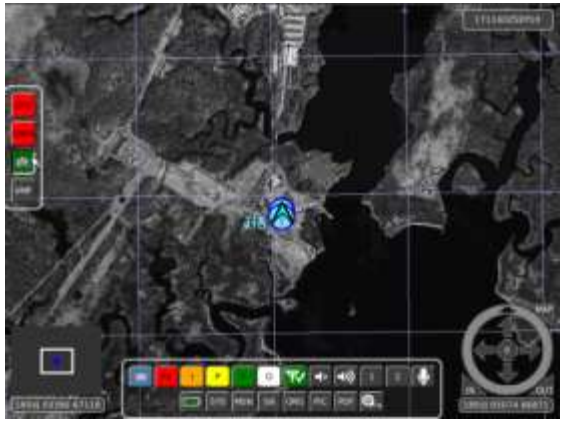
- **Future Goal: integrate wearable sensors on/in the uniform**

** JCAD is not designed to be a wearable sensor but was used to demonstrate sensor & network integration and assess improvements to situational awareness*

CB Network Preliminary Data

Soldier Display during MOUT Operations

Increased CBRN Situational Awareness for the Warfighter

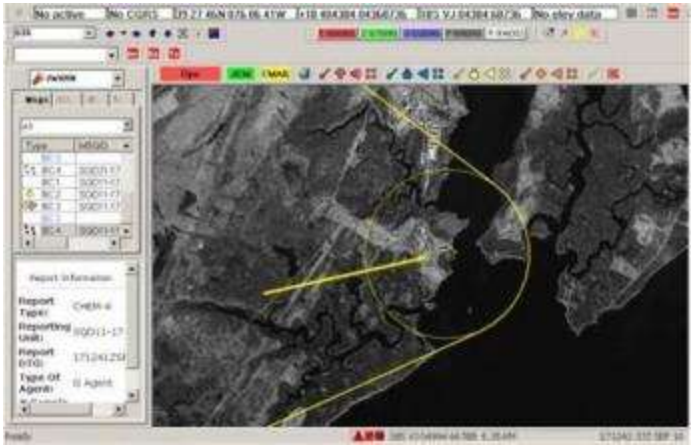


Soldier Display

Soldier Receives NBC Warning Message

Soldier Receives Initial Hazard Prediction

JWARN used to calculate the initial hazard prediction where the information is sent to the Soldier Display



Information flow between JWARN and the on-Soldier Display with relevant CBRN Information.

Summary

- **Integration of CB protection into "duty-uniform like" concepts feasible**
- **Reductions in thermal burden achievable through optimization of designs and materials**
  - Use of strategically placed vents aid in reducing thermal burden of protective garments in reduced protective posture but necessitates improved closure designs
- **Total combat load reductions demonstrated between 4.4-8 lbs (compared to current baseline CB ensemble)**
- **Integration of helmet and mask feasible**
- **Conformal filter technology allows for novel approaches to CB integrated head-gear design**
- **Improvements to situation awareness possible through CBRN sensor and warning integration with on-Soldier communications-** *Machine to Machine communications feasible and could reduce NBC message transmission times*
- **Formal transition to JPM-P for UIPE Increment I, JPM-IS and PEO Soldier planned for 3Q 2011**


JPM-IP
DTRA
NSRDEC
JPEO-CBD
ECBC
CB-GSS
Frigus Per Consensio
PEO SOLDIER

Questions?